

## Overview: Activity Three

Justifying environmental improvements in a quantitative and qualitative manner is a valuable skill with numerous real-life applications. This activity provides your students with the opportunity to see how much the world really *does* revolve around them and the decisions that they make. The students complete step 4 of the 5-step home lighting energy-saver detective scientific investigation by calculating the savings and pollution prevention opportunities from the data they gathered. They use their home lighting energy-saver detective research as data for 17 math problems designed to prove or disprove their hypothesis and the benefits of compact fluorescent lights (CFLs).

### Levels:

Grades 4-7

### Subject:

Real-life applications of mathematics, science, and social studies

### Concepts:

- Replacing incandescent light bulbs with CFLs saves energy, reduces air pollution, and lowers utility bills
- The analysis step is used to discern fact and opinion and understand how our experiences correlate with science and technology

### Skills:

Scientific investigation, observing, interpretive thinking, multiplication, division, word problems

### Objectives:

- Students will understand how to use the scientific investigation to make decisions that cut costs, save energy, and help the environment
- Students will complete step 4 of the 5-step home lighting energy-saver detective scientific investigation

### Materials:

- Energy-saving clue sheet (p. 27)
- In-class instruction sheets (pp. 25 & 28)
- Home Lighting Energy-Saver Detective

"Analysis: How much can I save?" (pp. 9-12)

"In-class Analysis: How much air pollution can our whole class prevent by using CFLs?" (p. 13)

## Background

Energy is measured in different ways in different parts of the world. In the United States, energy is commonly measured in British Thermal Units (Btu) and quads (quadrillion BTUs). The unit for electricity measurement is kilowatt-hours (kWh). Knowing how much energy is used for a particular need, such as powering the lights in our home, helps students understand how they can use technology to help the environment and save their families money.

It takes significantly more electricity for an incandescent light bulb to produce the same amount of light as a Compact Fluorescent Light (see pages 22, 29, 30, and 32). The technology used for incandescent light bulbs generates a lot of heat when it produces light. This heat is lost energy. In contrast, the CFL technology uses most of the electricity it draws to produce light rather than heat.

Because energy-efficient light bulbs use less electricity, less air pollution is created to supply the lights with power. These light bulbs usually cost more to purchase, but they last up to 10 times longer than incandescent light bulbs and cost less to use. As a result, these CFLs pay for themselves relatively quickly. After that, the money saved can be used for other family expenses.

This activity includes calculations to help students understand the savings and pollution prevention opportunities offered by CFLs. Some assumptions were made to simplify these calculations. For example, this activity assumes all light bulbs will be replaced, but in reality, most people only replace the lights in high-use areas. Some of the lights replaced will save more than 50 watts and others will save a little less. Utility bill savings are figured with an average kWh rate of \$.08, but your local rate may be higher or lower. The CO<sub>2</sub> multiplier on page 13 is two, but this

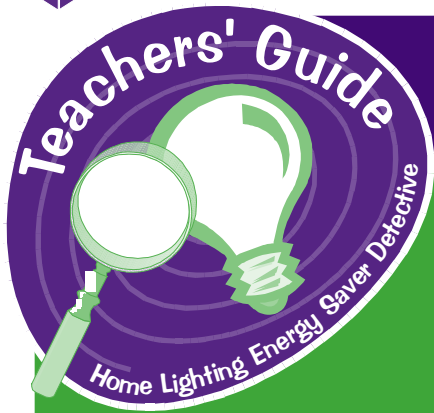
number will also vary depending on whether most of your electricity is produced with fossil fuels or renewable energy.

## Getting ready

- 1) Retrieve the transparencies you made from pages 25 through 28.
- 2) Copy the worksheet "Analysis: What can I save?" (pp. 9-12) on transparencies for instruction purposes.
- 3) Gather any other materials you have on scientific investigations (analysis), and prepare your remarks.
- 4) Make a copy of the worksheet "Analysis: What can I save?" (pp. 9-12) for each student in your class.
- 5) Make a copy of the worksheet "In-class Analysis: How much air pollution can our class prevent by using CFLs?" (p. 13).
- 6) Review the math problems and directions to determine which problems are best completed in class, and which problems are better for homework. (Note: Student page 3-5 is designed to be completed in class). Teachers with students in grades 4-5 may wish to complete problems 1-11 in class.

## Doing the Third Activity

1. Review the 5-steps of the home lighting energy-saver detective scientific investigation with the transparency you made from page 25.
2. Review the students' progress with their scientific investigation by showing the transparency you made from page 28.
3. Discuss the analysis step and its importance in solving real-life mysteries.
4. Show the students the transparencies you made from the student worksheets from pages 9-12.



5. Hand out the worksheet "Analysis: How much can I save?" (See Figure 3.1).
6. If time permits, have the students complete the first nine problems in class under your supervision to ensure that they are working with the correct data during their analysis.
7. Tell the students that they will calculate their environmental impacts as a class the next time the group gets together. (see figure 3.2.)
8. The next time the group gets together, hand out student page 3-5. Answer problems 15-17 in class.
9. Continue teaching the scientific investigative process by proceeding to the final activity four on page 15.

[illegible]

Figure 3.1.

[illegible]

Figure 3.2.



# Home Lighting Energy-Saver Detective Analysis: How much can I save?

Instructions for problems 1-8: use your homework, "Research: How much energy do I use" to complete this page. Write the number of light bulbs you counted for each room in the space marked "A." Don't forget to count each halogen torchiere 3 times (see student page 1-1 and example at right). Write the number of hours you circled for each room in space "B." Use the room picture clues to help you enter the correct information in the correct space. Then complete the math, and write your answer in space "C."



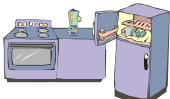




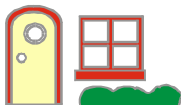
## Example:

Suppose you counted 2 light bulbs that were on for 4 hours in a room, you would write the problem like this:

$$\underset{A}{2} \times \underset{B}{4} = \underset{C}{8}$$

Suppose both bulbs were halogen torchieres, since they use 3 times as much energy, you would write the problem like this:

$$\underset{A}{6} \times \underset{B}{4} = \underset{C}{24}$$

1.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
2.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
3.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
4.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
5.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
6.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
7.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C
8.		<u>                    </u>	X	<u>                    </u>	=	<u>                    </u>
		A		B		C

9. Add the answers together from problems 1-8, space "C" and write your answer in this box



Hours of operation



## Home Lighting Energy-Saver Detective

Analysis: How much energy and money can I save with energy-efficient compact fluorescent (CFL) bulbs?

10.

Your answer in 9 tells you the total number of hours the light bulbs in your home operate each day. Each energy-efficient compact fluorescent light (CFL) bulb saves 50 watts, how many watt-hours could you save if you replaced the light bulbs you have now with these light bulbs.



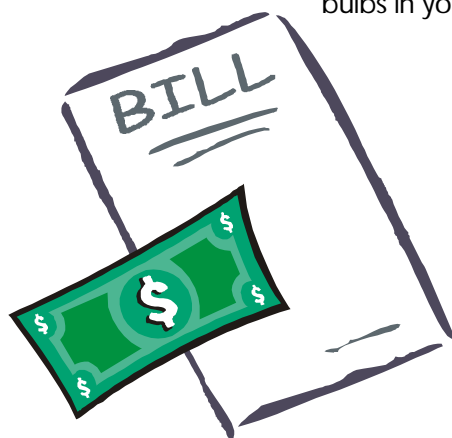
Answer in 9

$\times 50$   
Watts

$=$    
Watt Hours you would save

11.

Most utility bills show the electricity you use in kilowatt-hours. Since there are 1000 watt-hours in 1 kilowatt-hour, how many kilowatt-hours could you save by replacing the light bulbs in your home with energy-efficient compact fluorescent (CFL) bulbs?



Your answer in 10

$\div 1000$   
Watt hours

$=$    
kilowatt-hours  
you would save